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Totti Könnölä
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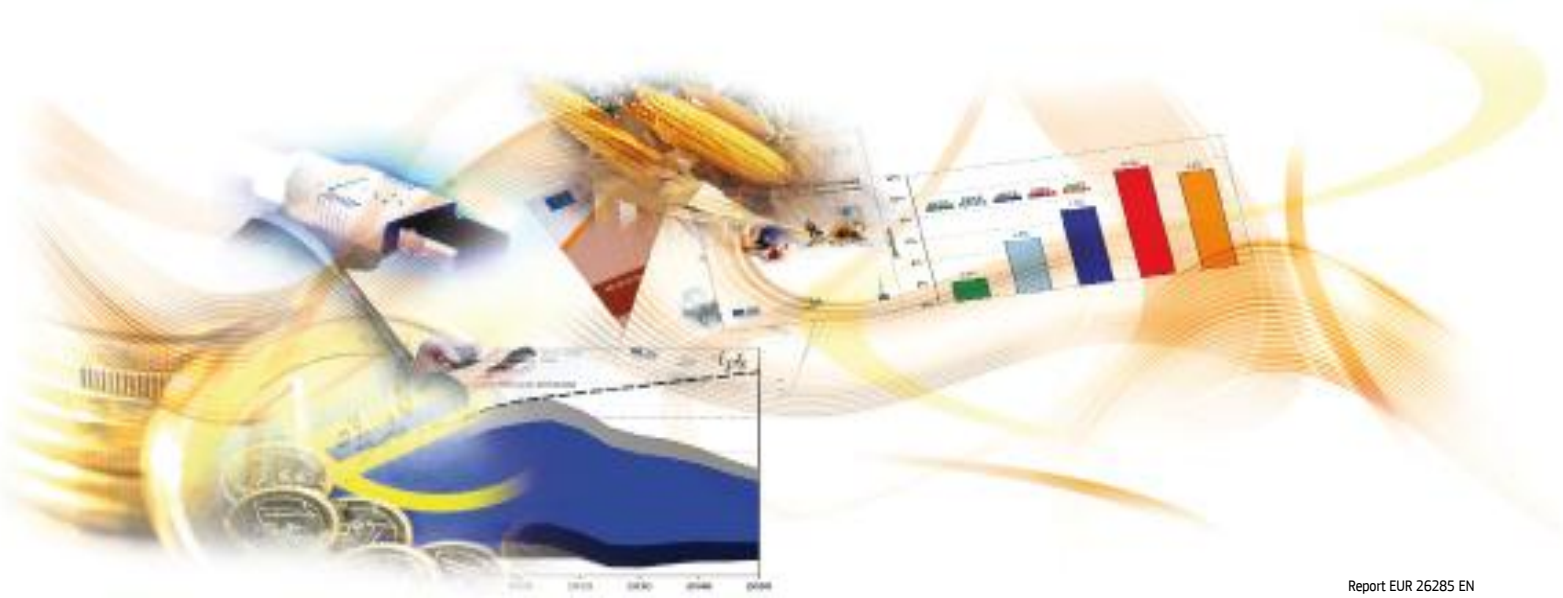

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The Country Report 2012 builds on and updates the 2011 edition. The report identifies the structural challenges of the national research and innovation system and assesses the match between the national priorities and the structural challenges**,** highlighting the latest developments, their dynamics and impact in the overall national context.

In particular, it has benefited from comments and suggestions of Nicholas Harrap from JRC-IPTS who reviewed the draft report. The contributions and comments from DG-RTD and the The contributions and comments from Dr. Anssi Mälkki (Research and Innovation Council of Finland) are gratefully acknowledged are also gratefully acknowledged.

The report is currently only published in electronic format and available on the ERAWATCH website. Comments on this report are welcome and should be addressed to jrc-ipts-erawatch-helpdesk@ec.europa.eu.

EXECUTIVE SUMMARY

Finland´s research and development expenditure exceeded EUR 7 billion in 2011. Although the R&D expenditure grew, its share of GDP turned to decline and was 3.78 per cent in 2011. In 2012 expenditure is estimated to fall by EUR 70 million, resulting in its GPD share at no more than 3.6 per cent (Statistics Finland, 2012). In Finland the private sector share of R&D funding is particularly high with around 67% of GERD (Eurostat, 2012). In terms of research inputs, measured by human resources in science and technology as a share of labour force (50.7% in 2009), Finland ranks well compared to the EU-27 average (40.1%) and is on the same level with other innovation leaders (European Commission, 2012).

Overall, the Finnish governance system is a strong mix of national and local administration allowing regions to have a relatively high degree of autonomy in the design and implementation of regional policies. Innovation policies and strategies, however, are guided and directed by the Finnish government, which decides on national development goals and lays down the general guidelines for regional innovation policy (Viljamaa & Lahtinen, 2011).

All in all, the private sector is an important knowledge provider in Finland with €5.05b R&D expenditures in 2011 (over 70% of the total R&D spending), €193m more than 2010. Private sector R&D is concentrated (more than 80% in 2010) in large businesses with over 250 employees. Moreover, the ten largest businesses account for 56% of all the private sector R&D. (Statistics Finland, 2012.)

The Government budget for 2013 includes two tax incentives aimed at growth seeking businesses. Action plan for research and innovation policy (2012) discuss also possible new policy instruments related to venture capital funds, lowering of corporate tax rate on revenues coming from intellectual property rights (IPRs) and innovation enhancing public procurements.

According to the Finnish National Reform Programme (2012), among the most important substantive reforms of the research and innovation policy are the creation and introduction of new means and models to strengthen innovation activity, the establishment of attractive clusters of expertise, internationalisation, structural development of higher education, reform of research institutes, and organisation of infrastructure policy and the tenure track system.

The institutional role of the regions in the research and innovation policy is small and most policy decisions are made at the national level. Regional concerns have an effect on the national policy in some respects, however. The government action plan for research and innovation policy foresees that regional cooperation will be intensified with the INKA (Innovative Cities) programme to be launched at the start of 2014 and which will replace OSKE. The programme encourages major urban areas in Finland to choose strategic focus areas and generate competence-driven business with the help of new kinds of development environments and lead markets supporting smart specialisation.

Evaluations are used extensively to assess the operation of individual organisations such as universities, the Academy of Finland or Tekes. The evaluation of Tekes was published in June 2012 stating and it stated, for instance that Tekes' activities have boosted research, development and innovation and enhanced their quality; and that Tekes should not be merged with other public financing organisations, such as Finnvera. Instead, the division of duties between actors in the field should be clarified and the assessment and selection process of financing applications must be expedited. The evaluation of the Academy of Finland was initiated in Autumn 2012. The Academy of Finland published also the state of the scientific research in Finland 2012,

which reviews the state and position of the Finnish research system in international comparison as well as the strengths of different scientific disciplines and areas in need of further development.

The external evaluation of the strategic centres for science, technology and innovation (SHOKs) (2013) provides insights on one of the main industry-driven instruments of Finnish innovation policy. For instance, despite major advances SHOKs also face important challenges that include i) multiple and often internally contradictory objectives, ii) tensions between short and long-term perspectives and iii) lack of international activities.

Building on the international evaluation (Ministry of Employment and the Economy & the Ministry of Education and Culture, 2009) and other policy documents the key challenges can be summarised as follows:

- Weak internationalisation of the research and innovation system
- The quality of scientific research
- The fragmentation of the higher education and the public research sector
- Strong emphasis on supply side measures
- Concentration of private R&D to few sectors and businesses.

The research and innovation system seem to respond actively to these challenges. For instance, in the end of 2012 the MEC and MEE prepared jointly an action plan for research and innovation policy as part of the government's strategy process that propose the following priority measures:

- Increasing the attractiveness of Finland and enhancing the internationalisation of the R&I system
- A research and innovation system with better quality and more flexibility
- Increasing effectiveness by expanding the scope of innovation activities and increasing experimentation
- Greater value and new competitive advantages through intangible investments.

Finland has generally taken an active role in participating in the ERA. The European dimension is seen as a natural extension of the national policy for a small country with limited resources. Finland has long experience in developing national, Nordic and European research programs encouraging healthy competition. Finland is also well represented in the European research landscape, being a member of all major European research organisations. However, the 2012 government action plan for research and innovation policy recognises that Finland has not utilised the opportunities offered by European and other international research funding to a sufficient degree. While the Finnish R&I system has a long track record in addressing the ERA priorities of the European Commission. Still, it remains an urgent need to upgrade the system and to develop these priority areas strongly related to the key challenges discussed earlier in this report.

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1 INTRODUCTION

Finland is a sparsely inhabited country with 5.4 million inhabitants located in northern Europe. By land mass Finland is the 8th largest country on the continent. The Gross Domestic Product (GDP) at market prices of Finland was €189 billion in 2011 and GDP at market prices per capita was €35,200 thus being clearly above the EU-27 average (Eurostat, 2013).

Finland´s research and development expenditure exceeded EUR 7 billion in 2011. Although the R&D expenditure grew, its share of GDP turned to decline and was 3.78 per cent in 2011. In 2012 expenditure is estimated to fall by EUR 70 million, resulting in its GPD share at no more than 3.6 per cent (Statistics Finland, 2012). In Finland the private sector share of R&D funding is particularly high with around 67% of GERD (Eurostat, 2012). In terms of research inputs, measured by human resources in science and technology as a share of labour force (50.7% in 2009), Finland ranks well compared to the EU-27 average (40.1%) and is on the same level with other innovation leaders (European Commission, 2012).

Overall, the Finnish governance system is a strong mix of national and local administration allowing regions to have a relatively high degree of autonomy in the design and implementation of regional policies. Innovation policies and strategies, however, are guided and directed by the Finnish government, which decides on national development goals and lays down the general guidelines for regional innovation policy (Viljamaa & Lahtinen, 2011).

Governance of the Finnish research system

As illustrated in the figure at the end of the chapter, the Finnish research and innovation system is divided into four operational levels. **The Finnish Parliament and the National government rule the highest level.** In matters related to research, technology and innovation policy, the latter is supported by a high-level advisory body, the Research and Innovation Council (RIC; formerly Science and Technology Policy Council of Finland). The RIC is responsible for the strategic development and coordination of Finnish research and innovation policies and is led by the Prime Minister.

The second level consists of the ministries, of which the Ministry of Education and Culture (MEC) and the Ministry of Employment and the Economy (MEE) play the key role with respect to research and innovation policy. MEE was reorganised in September 2011 and is responsible for innovation policy planning and budgeting. MEC is responsible for higher education and science policy related matters. Together these ministries account for over 80% of the government research and innovation funding with the MEC having around 45% of all funding and MEE around 36% of funding in 2011. The share of MEC has increased during recent years mainly due to additional funding to universities and the Academy of Finland.

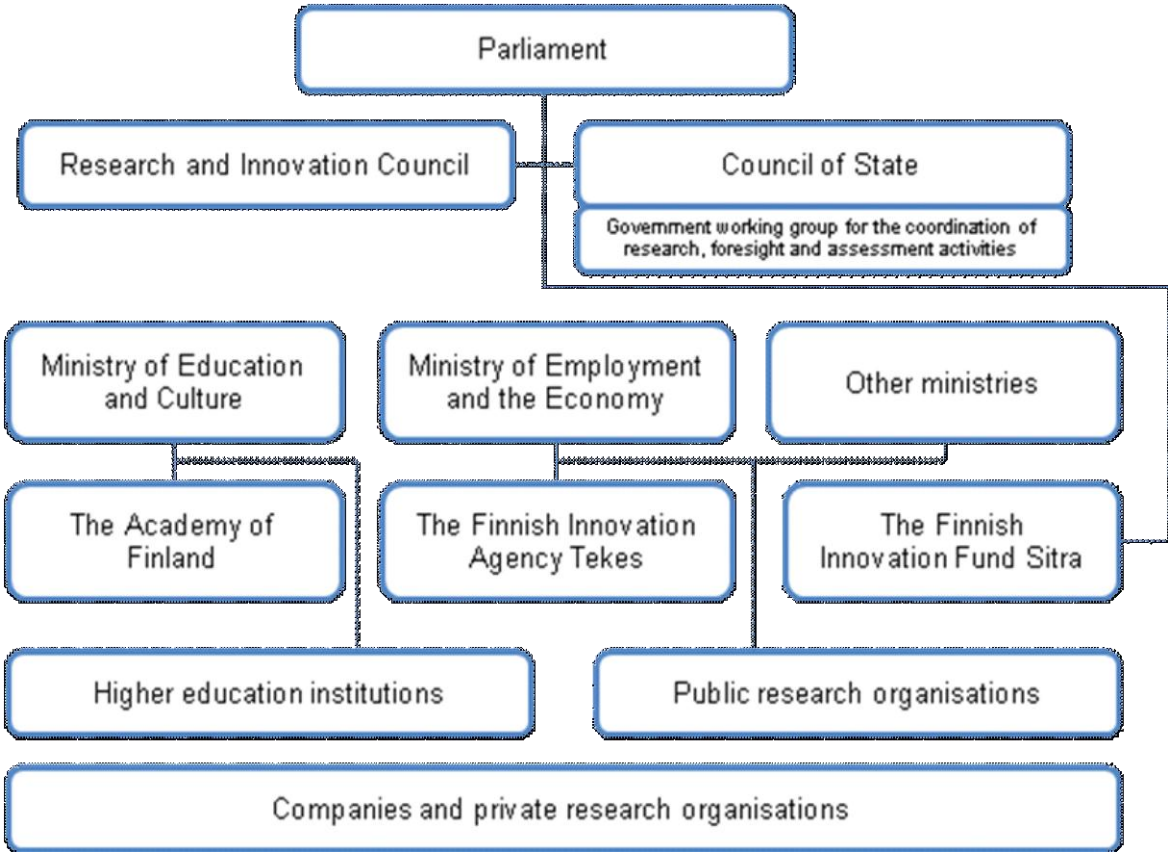
The R&D funding agencies, the Academy of Finland and Tekes, the Finnish Funding Agency for Technology and Innovation, **form the third level**. The former funds basic research through competitive grants (worth €384m in 2010) and the latter allocates the majority of its funds to R&D projects carried out by businesses. Tekes is also a large financier of research at the universities and public research institutes. In 2013 Tekes funding decisions is budgeted to amount to € 542m, 4.8% less than in 2012 (Statistics Finland, 2013).

Other important instruments are the R&D programmes by Tekes (such as the new programmes "Growth from Renewables 2010–2014", "Green Growth 2011-2015", and "Green Mining 2011-2016" launched in 2010 and 2011), the Academy of Finland and various ministries. Additionally,

the MEE has published an action plan for measures to support demand-led and user-driven innovation policy and the Academy of Finland has also published a strategy for research programmes.

The fourth level is comprised of the organisations that conduct research: universities (16), public research organisations (18), private research organisations and businesses. Due to the high number of universities, polytechnics and government research institutes the Finnish research system is rather decentralised. The biggest state research organisation is Technical Research Centre (VTT) with an annual budget of approximately €290m.. A proposal to reform the central government's sectorial research institutes has been made by an expert group in 2012 and it recommends to strengthen multidisciplinary research and to support large research projects.

Figure 1: Overview of the Finland's research system governance structure



Source: Research.fi, revised by the authors

2 RECENT DEVELOPMENTS OF THE RESEARCH AND INNOVATION POLICY AND SYSTEM

National economic and political context

In 2012, Finland's economic activity is expected to grow by 0.8% and by 1.6% in 2013. Unemployment is foreseen stay at 8%. Finland has experienced a strong recovery in recent years and economic fundamentals remain strong. The country is on track for balancing the general government finances by 2015 and it is taking steps to ensure the long-term sustainability of public finances (e.g. by introducing a reform to reorganize the municipal sector) (Council…, 2012).

The Finnish economy is similar to other western economies. Services account for more than two thirds of production (68.5 %) whereas the share of agriculture is small (3 %). Industrial production still plays a key role especially to exports although its overall share of production (28.5 %) is decreasing slowly. Important sectors in the Finnish economy are electronics and electricity, machine and metals industry, chemistry as well as pulp and paper. Within services significant branches are retail and business services, logistics and wholesale. Life sciences, health and well-being, clean technologies as well as creative industries/services are expected to become strong sectors in the future, which is reflected for instance in the new Tekes strategy (Tekes, 2011).

Since the recession of early 1990s Finland has been a forerunner in technology-based product and process innovations and is home to well-known telecommunications corporation – Nokia. There are other ground breaking businesses in Finland as well, including the elevator company Kone, the mobile game company Rovio, and several others such as Metso (forestry), Wärtsilä (mechanical engineering), and Suunto (manufacturing) amongst others. Some Finnish businesses have struggled with usability and user friendliness of products (the focus has been on technological innovations and too little attention has been paid to the needs of end-users) while others (especially Rovio) have succeeded in highly competitive user markets. A great majority of business R&D is still conducted by Nokia. All in all, the private sector is an important knowledge provider in Finland with €5.05b R&D expenditures in 2011 (over 70% of the total R&D spending), €193m more than 2010. Private sector R&D is concentrated (more than 80% in 2010) in large businesses with over 250 employees. Moreover, the ten largest businesses account for 56% of all the private sector R&D. (Statistics Finland, 2012.)

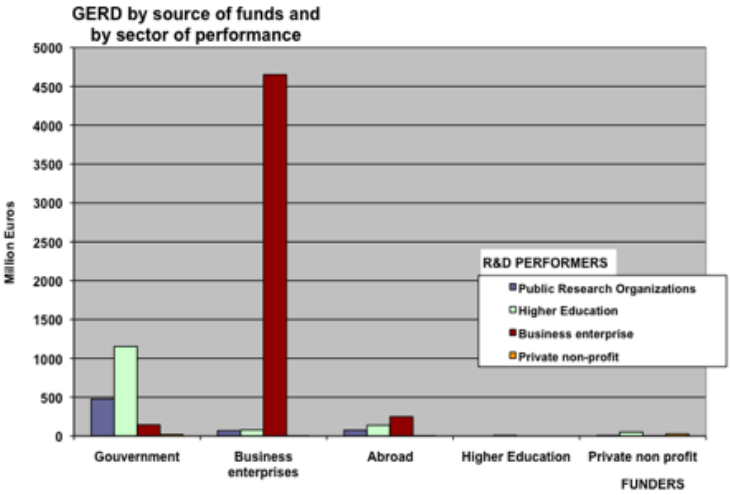
Finland is facing important challenges with respect to the long-term sustainability of the current standard of living due to an ageing population, industrial restructuring and a loss of competitiveness on international markets. Strengthening competition in product and services market has become increasingly important for boosting productivity and enhancing potential economic growth. Notwithstanding the past strong Finnish R&D and innovation performance, without a significant increase in the number of internationalising innovative high growth businesses, Finland's ranking as an EU innovation leader risks declining. There is continued need to lengthen working careers and to combat the rise in long-term unemployment as well as youth unemployment.

In December 2012, the government action plan for research and innovation policy described the operating environment of Finnish society, economy and research undergoing a rapid change:

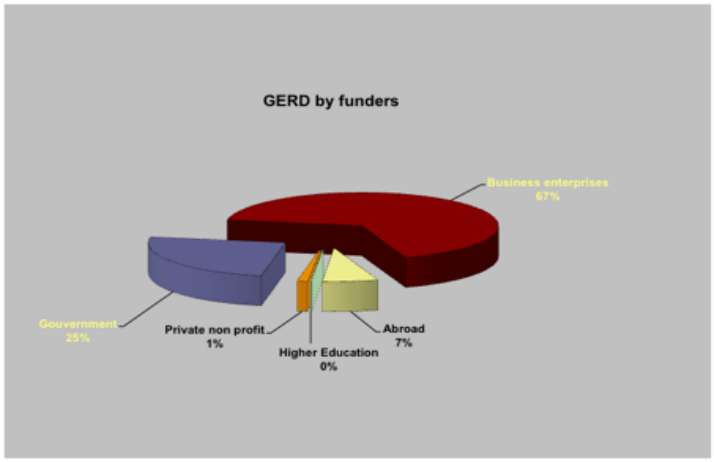
"International cooperation and competition have intensified, and uncertainties in the global economy have functioned to weaken our expectations for the future. The business sector is currently undergoing severe structural change. Responding to requirements related to the maintenance of the welfare society and sustainable development as well as the need for structural change within society and the economy constitutes the central framework for the research and innovation policy of the present government term."

Funding trends

Public R&D funding has increased in Finland regardless of the economic crisis. According to the research and innovation policy guidelines 2011-2015 (Research and Innovation Council of Finland, 2010), maintaining the current R&D funding share of GDP (almost 4%) in the 2010s remains an objective for Finland as well as a strong public commitment to increase R&D funding in the future. The recent Europe 2020 target for Finland is to have 4 % expenditure to R&D as a proportion of GDP by 2020.



The main flows of R&D funds are presented in the diagram for the year 2011. In Finland the private sector share of R&D funding is high with around 67% of GERD (Eurostat, 2012). Although private sector participates in the funding of the research carried out by the higher education and public sector, most of the funding goes to private R&D. The government funds around 25% of all R&D activity. From this amount 64% is directed to the higher education sector, around 27% goes to public research organisations (mainly sectorial research institutes) and approximately 8% to the private sector. Public research organisations perform about 9 % and the higher education around 20 % of all R&D activities.



Most of the university funding comes from various government sources, especially from the Ministry of Education and Culture but also from the main public R&D funders the Academy of Finland and Tekes, whereas the private sector finances 11% of the external R&D expenditures in the higher education sector. In general, the external funding of high education research and development increased 7% in 2011 from 2010 Statistics Finland (2012). The University of Helsinki, the Aalto University, the University of Oulu and the University of Turku are the largest higher education institutions in Finland and their share of R&D expenditures accounted for 61% (€732m) of the total R&D expenditure of universities in 2011 (Statistics Finland, 2012).

The amount of foreign R&D funding was around 7% of all R&D in 2011. More than half of funding from abroad (53%) was directed to the private sector. Around 30% of the foreign funding went to universities and 16% to the public research organisations. Private non-profit sector is relatively small, consisting of only 1% of all R&D funding.

Table 1: Basic indicators for R&D investments in Finland

	2009	2010	2011	2012 (estimate, if such data are available)	2020 national target	EU average 2011
GDP growth rate	-8.2	3.3	2.7	0.8	-	1.5
GERD as % of GDP	3.96	3.87	3.78	3.6	4	2.03 s
GBAORD (€ million)	1893,689	2009,055	2012,26	2070	-	3241s
GBAORD as % of GDP	1.11	1.16	1.09p	1.01	-	0.73 s
BERD (€ million)	4847,164	4,854,463	5.047,400	-	-	5925,035s
BERD as % of GDP	2.83	2.72	2.67	-	-	1.26 s
R&D performed by HEIs (% of GERD)	18.9	20.4	19.9	-	-	24.0
R&D performed by PROs (% of GERD)	9.1	9.25	8,8	-	-	12.7
R&D performed by Business Enterprise sector	71.4	69.6	70,5	-	-	62.3

S: Eurostat estimate P: Provisional

New policy measures

In March 2012, the Government made a number of major decisions in support of innovation policy, during its discussion on spending limits. In addition, the Government has decided to open up public data resources systematically and as soon as possible.

The Government budget for 2013 includes two tax incentives aimed at growth seeking businesses. **The Tax Incentive for Private Investors** targets business angels investing equity in SMEs. The incentive provides a possibility to postpone paying capital gains taxes as long as those gains are re-invested in qualifying businesses. **The R&D Tax Credit for SMEs** is a deduction from corporate income taxes tied to the wage costs of R&D personnel in Finland. This incentive is estimated to have a fiscal cost of up 200 million euros in the first year of operation. Presumably the R&D tax incentive supplements rather than replaces the current R&D subsidies.

Action plan for research and innovation policy (2012) discuss also two possible new policy instruments. The first concerns asymmetric returns in venture capital funds. The idea is that a public investor could cap its required rate of return to some pre-defined level (e.g., 8%), the excess of which would be distributed among the private investors in the fund. The second is an IPR Box, which would provide a lower corporate tax rate on revenues coming from intellectual property rights (IPRs).

The above mentioned action plan refers also to the reform of the Act on Public Contracts, so that public procurements pay greater attention to innovation activity perspectives. A target level is set to directing one per cent of public procurement towards purchasing of new solutions in the cleantech field. The generation and diffusion of innovations is promoted by setting a target percentage (such as 2 or 3 per cent) for public procurement that enhances research, development and innovation activities. Expertise in procurement is enhanced by strengthening and developing comprehensive support and advisory services in matters of public procurement related to innovation. Financial and other incentives for procurement related to innovation are developed as part of the Effectiveness and Productivity Programme of central government and the productivity.

Recent policy documents

Evaluation of the Finnish National Innovation System (2009): The Finnish research and innovation system is facing, and seriously needs, a radical reform. A new national innovation strategy, a university reform and a number of adjustments in the research and funding system are changing the direction of the Finnish research and innovation policy, concludes an extensive international evaluation study, published on 28 October 2009.

Research and Innovation Policy Guidelines for 2011–2015 (2010): In December 2010, the Research and Innovation Council adopted the policy report on education, research and innovation policy. This report forms the core document of Finland's policy on science and innovation for the term of government. The Council defines the main outlines of the national strategy and presents a development programme for the next few years. The aim is for Finland to strengthen its position among the world's leading knowledge- and skills-based countries. The development programme accelerates the research and innovation system reforms.

Programme of Prime Minister Jyrki Katainen's Government (2011): The Government Programme is an action plan agreed on by the parties represented in the Government and it sets out the main functions of the Government. The Programme of the current Government was submitted to Parliament in the form of a Government statement on 22 June 2011.

The Finnish National Reform Programme (2012): In 2010 the European Council decided on a new economic and employment strategy. Among others Finland's national targets include R&D spending at a minimum of 4% of GDP. According to the national programme, economic growth requires in Finland an improvement in competitiveness, the safeguarding of the long-term sustainability of public finances, diversification of the production structure, full utilisation of labour and increased competition.

Growth through expertise: Action plan for research and innovation policy (2012). As stipulated in a decision issued by the Research and Innovation Council in autumn 2011, the Ministry of Education and Culture (MEC) and the Ministry of Employment and the Economy (MEE) prepared an action plan for research and innovation policy as part of the government's strategy process. The aim of the action plan is to concretise and enhance the implementation of the government's research and innovation policies and document central development measures and adjustments required in the final half of the present term of government.

Research and innovation system changes

According to the Finnish National Reform Programme (2012), among the most important substantive reforms of the research and innovation policy are the creation and introduction of new means and models to strengthen innovation activity, the establishment of attractive clusters of expertise, internationalisation, structural development of higher education, reform of research institutes, and organisation of infrastructure policy and the tenure track system.

The Academy of Finland provides funding for the acquisition, establishment or **upgrading of nationally significant research infrastructures** that promote scientific research. The Finnish Research Infrastructure Committee (FIRI Committee) will update Finland's national roadmap for infrastructures in 2013 at the latest and assess the urgency and priority order of projects included in the roadmap.

The most significant structural change in recent years has been t**he university reform** (with the new University Act in 2010) that has addressed the issue of universities to have more flexibility to promote high-level research, internationalisation and focusing of resources. The act has also enlarged the autonomy of universities, making them autonomous legal entities. This has been followed by mergers of several universities decreasing the amount of universities to 16. Also a new university funding model and reform came into force in January 2013. The aim of this model is a better, more efficient international university system with stronger impact and a better-defined profile. One key change proposed by the committee to the model used in 2010–2012 is greater emphasis on quality. Funding will no longer be allocated on the basis of target number of degrees, and the relative weight of scientific publications is expected to grow. Universities have also introduced a tenure track as the core academic career system to offer well-supported career path based on the principle of commitment from university and individual to academic career; it has clearly defined expectations, incentives, and assistance in personal development (see more, for instance on the tenure track of Aalto University).

In parallel, **the polytechnic reform** recorded in the Government Programme started in September 2011. The aim is to draft a government proposal for a new Polytechnics Act, which is to take force from the beginning of 2014. According to the Government Programme, the responsibility for polytechnic funding as a whole will be transferred to the government, and polytechnics will be made independent legal persons. The objective is to strengthen the role of polytechnics as increasingly independent and responsible educators of experts, reformers of working life and builders of the competitiveness of the regions. The reform is implemented via changes in legislation and the renewal of operating permits.

On 15 December 2011, the Research and Innovation Council decided to appoint an expert group to prepare a proposal on **the overall reform of the national research institute sector**. In order to develop research that supports social policy and the various functions and services within society, and the steering and funding models for such research, the expert group proposes the following:

- The structure of research institutes will be reformed by merging research institutes into stronger ones, in both operational and structural terms, while the interdisciplinary and multidisciplinary nature of research conducted in such institutes is strengthened;
- Research resources will be marshalled in order to increase their social effectiveness, through research supporting governmental decision-making, and also through the establishment of a funding instrument for strategically targeted research, to be employed in solving significant social challenges and problems; and

- Cooperation between research institutes and universities will be intensified and developed, to shape universities and research institutes into clusters of research, innovation and higher education that are key actors in producing research that supports society.

The Government made the first definition of the policy on October 10, 2012. Political discussions on the implementation have started and the decision in principle is expected in spring 2013.

Regional and/or National Research and Innovation Strategies on Smart Specialisation (RIS3)

The institutional role of the regions in the research and innovation policy is small and most policy decisions are made at the national level. Regional concerns have an effect on the national policy in some respects, however. For instance, the Ministry of Education and Culture reconciled the objectives of the national research policy and the regional policy in a strategy document entitled "Regional strategy for accomplishing education and research policies until 2013".

Regional Councils are appointed by the municipalities and are therefore politically representing the local governments. The main instruments for funding their policies are the Operational Programmes co-funded by Structural Funds (SF), the national government and the local governments. With the increasing focus of SF towards research and innovation, the role of regions as research and innovation policy actors has become somewhat more important.

The regional actors together with the national government and Higher Education Institutions have jointly contributed to the establishment of six regional university centres in several non-university towns. The university centres gather the operations of several universities in one location in these towns. As a result, the amount of research laboratories and research groups located in various locations has grown rapidly.

In the programming period 2007-2013 the Centre of Expertise Programme has been administered by the MEE and it has formed national clusters of expertise to enhance networking between the regional centres of expertise and to function as the new platform for development of inter-regional co-operation. The new cluster-based operational model is expected to enable a more efficient utilisation of resources scattered in different regions, and is also intended to increase the "critical mass" for R&D activities in these fields. For the new programming period, a total of 13 clusters with national significance were selected with a total of 21 regional Centres of Expertise participating in these clusters. However, it covers research policy and related activities only indirectly by pooling local, regional and national resources for the exploitation of top-level expertise. The programme supports regional strengths and specialisation by launching co-operation projects between the research sector, educational institutions and industry.

Special programmes have been drawn up by the Finnish government to attain the targets of regional development in Finland. The programmes are the on-going Centre of Expertise Programme (OSKE)Centre of Expertise Programme (in Finnish OSKE)Centre of Expertise Programme (OSKE) and the Regional Cohesion and Competitiveness Programme (in Finnish KOKO-) that ended in 2011. The government action plan for research and innovation policy foresee that regional cooperation will be intensified with the INKA (Innovative Cities) programme to be launched at the start of 2014 and which will replace OSKE. The programme encourages major urban areas in Finland to choose strategic focus areas and generate competence-driven business with the help of new kinds of development environments and lead markets. The aim is to use investments in development made by the state and the urban regions

in order to generate openings that are based on international competence and also provide international visibility. Resources from structural funds from the period 2014–2020 are directed to comparable projects in innovation clusters. Major land use, housing and traffic infrastructure projects implemented in cities will be used as new types of development and testing environments for innovations. A region-specific negotiation procedure will be created for the most significant innovation clusters, with participation from national financiers, such as the Finnish Funding Agency for Technology and Innovation (Tekes), the Ministry of Employment and the Economy and, where necessary, the Ministry of Education and Culture and other ministries. The growth agreement, also coordinated by the Ministry of Employment and the Economy, requires cities making choices in accordance with the Smart Specialisation Strategies of the European Union.

Evaluations, consultations

Government reviews, studies, evaluations and guidelines act as the instruments that guide and inform science policymaking at the national level. The Government working group for the coordination of research, foresight and assessment activities is a body facilitating cooperation and exchange of information between the Finnish ministries. Once during each electoral period, the Government submits to Parliament a foresight report on long-term perspectives. The focus of each report is on a defined set of strategically significant issues that will impact the Government's key policies over the coming 10-20 years. The foresight report gives the Government's view on the chosen issues and associated policies. Several different types of foresight activities have also been carried out for instance by the Committee for the Future, one of the 15 standing committees of the Parliament of Finland, by the ministries, Tekes and the Academy of Finland as well as research institutes and universities. Foresight studies have often been organised in association with research programmes of the Academy of Finland or Tekes programmes and their focus has been rather narrow.

Evaluations are used extensively to assess the operation of individual organisations such as universities, the Academy of Finland or Tekes. The evaluation of Tekes was published in June 2012 and it stated, for instance that Tekes' activities have boosted research, development and innovation and enhanced their quality; and that Tekes should not be merged with other public financing organisations, such as Finnvera. Instead, the division of duties between actors in the field should be clarified and the assessment and selection process of financing applications must be expedited. The evaluation of the Academy of Finland was initiated in Autumn 2012. The Academy of Finland published also the state of the scientific research in Finland 2012, which reviews the state and position of the Finnish research system in an international comparison as well as the strengths of different scientific disciplines and areas in need of further development.

The external evaluation of the strategic centres for science, technology and innovation (SHOKs) in 2013 provides insights on one of the main industry-driven instruments of Finnish innovation policy. For instance, despite major advances SHOKs also face important challenges that include i) multiple and often internally contradictory objectives, ii) tensions between short and long-term perspectives and iii) lack of international activities.

Policy developments related to Council Country Specific Recommendations

The Council Country Specific Recommendations support Member States and the Commission in coordinating their economic and budgetary policies. In relation to research and innovation the 2011 recommendations advised Finland to continue efforts to diversify the business structure, in particular by hastening the introduction of planned measures to broaden the innovation base while continuing to align wage and productivity developments.

The Government has safeguarded an adequate level of research, development and innovation funding and clarified the division of responsibilities of actors that distribute public financing. In particular, the following measures have been taken forward in response to the commitment to the National 2020 R&D target of 4%/GDP: Research and development tax deduction and temporary growth; entrepreneurship incentive, reallocation of public research funding; a proposal for a reform of central government research institutions. However, according to Statistics Finland, in 2012 GERD is estimated to fall by EUR 70 million, resulting in its GPD share at no more than 3.6 per cent. As mentioned earlier in this section, research and innovation tax incentives for businesses have been strengthened.

In 2012 the Government also introduced new measures that will enhance especially through the INKA programme the role of the regions in implementing the national innovation strategy as growth platforms for innovations. A negotiating procedure and growth agreement preparations have been initiated for the creation of appealing innovation clusters. This will promote cooperation and coordinate the use of resources between key actors in the metropolitan regions and central government (see also earlier this section).

3 STRUCTURAL CHALLENGES FACING THE NATIONAL SYSTEM

Finnish strategic objectives for research and innovation policies have undergone gradual changes during the past years. One of the key points identified in the 2009 international evaluation was that despite having good labour productivity development and high levels of R&D, the main weaknesses of the Finnish research and innovation system are a lack of growth entrepreneurship and difficulties in internationalisation (Ministry of Employment and the Economy & the Ministry of Education, 2009). There are also several structural problems in the system with a complex support system as well as structural challenges related to research performers (universities and public research organisations). Based on the international evaluation and other policy documents (see Section 2) the key challenges can be summarised as follows:

1. *Weak internationalisation of the research and innovation system*

Internationalisation of science has been a policy objective in Finland for quite some time, but so far the results of the policy measures have been modest. According to report on the state of scientific research in Finland 2012 only 13% of the researchers in Finnish universities were foreigners. The same report also notes that co-publishing with foreign researchers has increased considerably since 1990; between 2006 and 2009 49% of scientific publications were co-published with foreign researchers. The share of foreign R&D-investment as a share of private R&D in Finland was 7% in 2010 (OECD, 2012), which is low in international comparison. In this light, it is not surprising that specific strategies for internationalisation have been designed for the higher education sector as well as for the Academy of Finland.

The structural weakness of internationalisation also applies to human resources more broadly. The international evaluation of the research and innovation system in 2009 concluded that the "lack of global insight and foreign expertise" gained through foreign immigrant human capital, foreign R&D investments and venture capital investments is a major challenge in the global knowledge economy. In addition to that the level of foreign direct investment is low compared to other leading countries; in terms of commercialisation, there is also a visible lack of foreign co-patents (Ministry of Employment and the Economy & the Ministry of Education and Culture, 2009).

It has been also noted that a particular challenge for Finland in its efforts to attract foreign talent relates to research and innovation environments and researcher salaries in the public and higher education sectors, which in many cases have not been competitive enough (Viljamaa et al., 2010). Many other countries have also invested more in developing national research infrastructures than Finland, for example, with concrete investment programmes for several years (Viljamaa et al., 2010). The university reform addresses partly these challenges (see, Section 2).

2. *The quality of scientific research*

The 2012 report on the review of the state of research in Finland evaluates Finnish research as relatively good and stable; however, what remains a concern is that the number of researchers at the very top of their field remains low in Finland. Finland needs more high-quality, leading edge research. In 2008–2010, a total of 15,674 scientific publications were published in Finland, 6% more than in the mid-2000s. Finnish publications received 6% more citations than world publications on average in 2008–2010. This is slightly more than in the early part of the period under review, when Finland's relative citation impact was around the world average. In 2008–

2010, 9% of Finnish publications ranked among the world's top publications. This is roughly the same figure as in the world on average and behind other Nordic countries.

Finnish universities in general do not fare that well in international comparisons. The only Finnish university ranked in top-100 of the Shanghai ranking in 2012 is the University of Helsinki. Also in the Times Higher Education World University Rankings in 2013, the University of Helsinki is the only Finnish university among the best 200 universities in the world. However, most Finnish universities rank average in the international university rankings due to relative few fields of international excellence. The regional policies of Finland may have also affected the level of science in several Finnish universities while several of them have been established in remote locations based more on equal regional policy than actual demand.

3. *The fragmentation of the higher education and the public research sector*

The quality of research and its efficient use in the society is linked with the structure of the research system. According to the international evaluation of the Finnish research and innovation system (Ministry of Employment and the Economy & the Ministry of Education, 2009) the Finnish higher education and public research system is fragmented, which makes it more difficult to focus resources and to provide high-level research. According to the evaluation the system can be seen as fragmented in three dimensions: firstly, resources are scattered in three different types of organisations with overlapping tasks – universities, polytechnics and public research organisations (PROs). Secondly, these institutions are scattered around the country with several rather small units. Thirdly, the universities have been internally fragmented in several rather small units. (Viljamaa & Lahtinen, 2011.)

4. *Strong emphasis on supply side measures*

The Finnish research and innovation system relies mainly on supply side instruments for R&D support. This has been effective in the past but may lack the dynamic for supporting those research fields and industry sectors that are new, on the rise and outside the scope of current strategies. There is an initiative to develop more demand-side policies to support innovation but it is still in the early stages of development.

In terms of policy and the functioning of the research and innovation system, policy makers seek to cater for the needs of a wide spectrum of potential users who operate under a range of circumstances. As a result, the business support system has become excessively complex to both access and administer. From the perspective of an outside observer (such as, for instance, a potential entrepreneur), programmes often seem to overlap with other programmes and on some occasions multiple public agencies appear to work broadly in the same area and/or with the same firm (Ministry of Employment and the Economy & the Ministry of Education and Culture, 2009).

5. *Concentration of private R&D to few sectors and businesses*

Since Finland is characterised by a high level of BERD it is important to notice the high dependency of the system on one specific sector, ICT and especially the cluster that has been developed around one company, Nokia. In 2010, 52% of private sector R&D was concentrated in the Electronics, computers and electronic devices sector (Statistics Finland, 2012). Finland has a growing entrepreneurship culture, a relatively robust venture capital industry and a very high relative number of young patenting firms (OECD, 2012). International co-operation in science and innovation is mixed: 50% of scientific articles, slightly above the OECD median, but 19% of PCT patents, below the OECD median, are produced (OECD, 2012).

Businesses in general have high investment rates in innovation activities (3.37% of turnover) (Statistics Finland, 2011) and there is also a high involvement of the private sector in the financing of domestic R&D activities. The number of joint publications between private and public actors is also relatively high.

Another specific feature that has been identified is that Finland is not specialising in education-intensive sectors in production (and trade) as much as some other smaller economies. There is a heavy specialisation in high-tech and especially in ICT industries and manufacturing specifically, but less so in human capital-intensive production. This is also evident in the fact that the share of services and especially knowledge intensive services is lower in Finland than in other leading countries (for instance Denmark, Sweden, and Belgium). These lead to a general challenge in that compared with high level R&D investments and business R&D, a relatively few world class advanced class services or goods originate from Finnish innovations or Finnish entrepreneurial firms (Ministry of Employment and the Economy & the Ministry of Education, 2009).

It also seems that despite several instruments and organisations addressing innovative businesses there is a lack of more general support for entrepreneurial culture and especially a culture for going global. This has been evident in the lack of support for entrepreneurship as a career choice in the university system. Especially growth entrepreneurship and the development of young innovative businesses have been considered a key challenge for policy and measures to address these issues have been planned. Entrepreneurial activity has, however, risen after the economic crisis and among the 59 countries assessed in the Global Entrepreneurship Monitor (2010) Finland ranks the 32nd (Stenholm et al., 2010).

Overall, one of the key challenges identified is the research and innovation system as a whole has over the decades become complex and difficult to administer. As a result, recommendations to make reforms in the whole education, research and innovation system have been suggested since 2009 (see Ministry of Employment and the Economy & Ministry of Education and Culture, 2009).

HUMAN RESOURCES	
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	2.9a
Percentage population aged 25-64 having completed tertiary education	45.7b
Open, excellent and attractive research systems	
International scientific co-publications per million population	1249.4b
Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	1165c
Finance and support	
R&D expenditure in the public sector as % of GDP	1.15b
FIRM ACTIVITIES	
R&D expenditure in the business sector as % of GDP	2.69b
Linkages & entrepreneurship	
Public-private co-publications per million population	104.7d
Intellectual assets	
PCT patents applications per billion GDP (in PPS€)	9.57d
PCT patents applications in societal challenges per billion GDP (in PPS€) (climate change mitigation; health)	0.56d
OUTPUTS	
Economic effects	
Medium and high-tech product exports as % total product exports	45.6b
Knowledge-intensive services exports as % total service exports	38.5a
License and patent revenues from abroad as % of GDP	0.91b

Data Source: Innovation Union Scoreboard 2011
a= 2009
b=2010
c=2007
d=2008

4 ASSESSMENT OF THE NATIONAL INNOVATION STRATEGY

National research and innovation priorities

Innovation and research policy has been increasingly connected with societal issues (for example, globalisation, ageing, the environment and public health) that pose a challenge to growth and well-being. These challenges can be tackled with public sector innovation (or public procurement), growth entrepreneurship, service innovation as well as user and demand driven innovation. Tekes also has a specific programme "Innovations in social and health care services 2008—2015" targeting issues related to society and well-being.

Moreover, societal issues are emphasised in the research and innovation policy review 2011-2015, drawn up by the RIC once in every term of office. Challenging economic circumstances and the need for a more open and dynamic operational environment have been acknowledged in the review that suggests doing things in a different way (including development of structures and encouragement of experiments). The main objectives of the review are the following:

- Grand societal challenges are systematically considered in the alignment of education, research and innovation, in the resources and in the development of actions and measures
- Internationalisation will be expedited, Finland's visibility and attractiveness as a location for living and business will be strengthened.

Additionally, reorganisation of resources is considered necessary in order to be able to gather an adequate level of critical mass. More funding is also called for from the private sector alongside public sector funding. The national objective is to keep the research and development funding of approximately four per cent of GDP, including a Government contribution of 1.2% of GDP. The various strategy documents have followed a relatively consistent development path. New measures have been introduced to support demand and user driven innovation, as well as service innovation.

The key "hot topics" in Finland have been demand driven innovation, user-centred innovation service innovation and the support of business growth and internationalisation (growth entrepreneurship). Tekes has also renewed its strategy (Growth and wellbeing from renewal) in 2011 giving priority to growth-seeking, innovative SMEs. The specific thematic and sectoral focus of the research and innovation policies is also best seen in the Tekes priorities. Emphasis is placed on strategic innovations on six focus areas: natural resources and sustainable economy, vitality of people, intelligent environments, and business in global value networks, value creation based on service solutions and intangible assets and renewing services and production by digital means. The role of service innovation becomes even more important as they and non-technical contents are considered as important as industry and technologies. A more customer-oriented and flexible approach is also one of the cornerstones of the new strategy.

Since the international evaluation of the research and innovation system in 2009, the main challenges outlined in Section 3 have been recognised in the government and a number of guidelines and policy documents have been published (see, e.g. Section 2). In the end of 2012 the MEC and MEE prepared jointly an action plan for research and innovation policy as part of the government's strategy process. Proposals for priority measures by the government consist of:

- Increasing the attractiveness of Finland and enhancing the internationalisation of the R&I system

- A research and innovation system with better quality and more flexibility
- Increasing effectiveness by expanding the scope of innovation activities and increasing experimentation
- Greater value and new competitive advantages through intangible investments.

Evolution and analysis of the policy mixes

Finland's research and innovation system is currently undertaking a new round of reforms and refocusing its strategy including simplifying a complex and overlapping system, reviewing organisations and programmes, and reducing the number of R&D-related organisations and universities. There has not been a true need for new measures that would make the Finnish national research and innovation system even more complicated. Still a few changes or increases in emphasis can be identified in the innovation policy mix. For instance an increasing focus on welfare and societal issues in the research side can be identified. Additionally there is an increasing focus on partnerships and collaboration as more SHOKs have been able to launch their activities in full scale. All in all, the government has taken or initiated planning of a number of measures to respond key challenges outlined in Section 3.

1. *Weak internationalisation of the research and innovation system*

In 2012 the government action plan for research innovation policy referred also to the national IPR strategy that accounts for challenges related to the internationalisation of the operating environment; a new feature related to the competition over the geographical location of Enterprises consists of special incentives to do with the taxation of income obtained through the utilisation of the immaterial property rights of Businesses.

2. *The quality of scientific research*

One area that has witnessed growth during recent years has been the support for scientific (public) research. For instance, the university reform has led to increased public funding for universities and the Academy of Finland. The support for scientific research is linked with three of the structural challenges of Finland – weak internationalisation of the research and innovation system, the quality of scientific research and its better application, as well as the fragmentation of the higher education and the public research sector.

In terms of human resources, the amount of researchers (FTE) in Finland was 55,897 in 2010 (The Academy of Finland, 2012). The large number of researchers and doctoral degrees is partly explained by the Finnish graduate school system consisting of 110 graduate schools with about 1600 graduate students. Despite the increasing amount of researchers, having a sufficient pool of qualified human resources is one of the key challenges in Finland. There is an increasing need to attract foreign researchers and other experts to the country in order to maintain the high level of R&I activity due to worsening age profile and decreasing levels of Finnish citizens graduating.

The government action plan states that in order to develop the preconditions for basic research of an international level, a targeted 10-year research-funding scheme should be adopted alongside the current funding instruments in use by the Academy of Finland. The aim is to promote high quality basic research through funding based on scientific quality that is for a fixed-term yet covers a significant time period. The state of research infrastructures is also widely considered as moderate and as old, and highly fragmented. Several changes are underway to improve research infrastructures, including the overall reform of the national research institute sector discussed in Section 2.

3. *The fragmentation of the higher education and the public research sector*

The universities and other higher education institutions are developing distinct research profiles in order to stand out in Europe or the rest of the world. Although university reform has advanced in recent years, and many successful organisational changes have been carried out, there have been difficulties in implementing structural reforms in PROs. This sector has only recently faced some organisational mergers or regrouping of tasks. One recent example is a consortium of the expert authorities for social welfare and healthcare. The consortium is a partnership for research between the National Institute for Health and Welfare, the Finnish Institute of Occupational Health and the Radiation and Nuclear Safety Authority, established by the Ministry of Social Affairs and Health in January 2011 to coordinate research and expert services.

However, the Government is committed in continuing the reform process. As explained in Section 2, an expert group, appointed by the Research and Innovation Council, has put forward a proposal for a comprehensive overhaul of state research institutes and research funding since 2014. The structure of state research institutes is to be reformed by fusing research institutes into stronger units, in both operational and structural terms, with the aim of reinforcing the interdisciplinary and multidisciplinary nature of research conducted in such institutes.

4. *Strong emphasis on supply side measures*

There is a clear aim to strengthen the role of demand and user-oriented innovation policy instruments as well as increase the focus on growth businesses. An action plan and policy framework for demand and user-driven innovation was outlined by the MEE in 2009. The framework includes the key elements of a demand and user-driven innovation policy in 2010 while the action plan 2010-2013 covers the action points that promote policy implementation in the private and public sectors.

Prior to 2009 the role of innovation oriented public procurement was quite modest in Finland but the development of public procurement in research and innovation policies is underway and high on the political agenda. For instance the Research and Innovation Policy Guidelines for 2011–2015 (2010) places emphasis on public procurement by referring to it as one of the key tools of demand driven innovation policy. The development of public procurement is also one of the key themes in the action plan and policy framework for demand and user-driven innovation. The main key barriers in implementing demand-side policies in Finland are the small domestic markets and to some extent the dispersed local government sector. As a result active participation of Finnish organisations to the EU Lead Market is seen as a very important approach in the action plan by the MEE. On the other hand the small markets can possibly work as an efficient pilot market for global innovations. One of the Tekes programmes also targets innovative public procurement since 2009. Its main aim is to encourage businesses to develop new innovations, renew public services, increase productivity, and to create new markets. An additional aim of the programme is to promote the use of public procurement as a tool for innovation policy as well as to develop good practices.

5. *Concentration of private R&D to few sectors and businesses*

As a whole, when assessing the importance of various policy mix routes in Finland, stimulating greater R&D investment in R&D performing firms and increasing extramural R&D carried out in cooperation with the public sector are by far the most important routes. Most of the Tekes instruments and SHOKs (also partly financed by Tekes) are the key measures for this route.

Promoting the establishment of new indigenous R&D performing firms has become increasingly important and increasing R&D in the public sector has also been on the agenda for a long time. However, in absolute terms these routes are still relatively small. Attracting R&D performing firms from abroad is also in the discussion and there is some inward investment activity both at the national and local level but investments in these activities is still relatively low. These actions are necessary steps in addressing the challenge of private sector R&D concentrating on few sectors and businesses.

Several instruments supporting new R&D performing firms have existed in Finland for some time. One of them is the R&D project funding of Tekes that consists of grants and loans and plays an important role in the policy-mix. In the projects Tekes is responsible for, half of the funding is provided while a corresponding proportion of private funding is also required. One relevant shift (although not visible in the policy measures but their funding) is the increased fraction of R&D-funding allocated to SHOKs. This increase mirrors the efforts that are focusing national strengths and top know-how to some key areas that are hoped will be competitive in global networks.

The MEE has established a Growth Enterprises group within the Enterprise and Innovation Department, which bears responsibility for structuring, developing and implementing the growth enterprise policy, as part of the broad-based innovation and industrial policy. The emphasis on growth enterprises has led to the establishment of the VIGO accelerator programme (launched by MEE in 2009) designed to complement the Finnish innovation ecosystem by bridging gaps between early stage technology firms and international venture funding. Through VIGO, target enterprises can gain access to both private and public funding sources. The programme is coordinated by Tekes. Other notable incubators aimed at supporting growth enterprises are, for example, Startup Sauna, the Spinno Enterprise Center and the Aalto Start-Up Center.

Tekes, on the other hand, has reformed its strategies and instruments aimed at better supporting new growth enterprises. In particular, project funding for businesses, according to the new strategy, will be targeted in the following ways:

- One third for young SMEs
- Roughly one third for established businesses with less than 500 employees
- Less than one third for businesses with more than 500 employees if external impacts on other actors are significant, or if the company is essentially reinventing its business operations

Funding will be channelled through different operating methods, which are:

- Around 40% for customer initiatives based on demand;
- Around 20% for research programmes of the Strategic Centres for Science, Technology and Innovation (SHOK);
- Around 25% to focus areas through Tekes programmes;
- Around 15% to other strategic choices

Alongside Tekes, the Growth Company Service of Enterprise Finland provides funding instruments to support SMEs. Additionally Finnvera (a specialised financing company owned by the State of Finland), VeraVenture (subsidiary of the former), Finnish Industry Investment and regional ELY-Centres all have instruments that support innovative start-ups. Most of these instruments are related to general funding support for businesses but in many cases these also target (innovative) start-ups.

Public sector financing support has also been directed towards seed-financing and loans. Finnvera plc, Sitra and Tekes represent public financing on equity terms. Seed financing is provided amongst others by Seed Fund Vera Ltd and the Finnish Industry Investment through the Financing Programme for Early Stage Companies. Tekes has a wide range of funding instruments to support innovation in businesses. Tekes provides for instance, funding for start-up businesses through the "Young Innovative Companies - programme". Innovation is one of the key criteria for funding as the firms operations have to be based on an innovative business idea based on specific expertise or new technology. Another instrument launched by Tekes is the Funding for the purchase of innovation services that aims at promoting business development of innovative SMEs.

The Nordic Growth Entrepreneurship Review 2012 reports that Finland nurtured 92 young growth enterprises in 2006–2009, whereas both Norway and Sweden were able to support over twice as many. The young growth company birth rate is 0.56% in Finland and 0.70% in Sweden. On the bright side, it seems that the Finnish growth enterprises grow faster and become larger than their Nordic peers. The same review also states that in the course of 2012–2013 Nokia, and to a lesser extent some other established businesses in the Finnish ICT sector, will release some ten thousand highly skilled individuals to the local labor market. Nokia has been very active in supporting the entrepreneurial efforts of those that leave the company. Depending on the case, it may offer to pay the individual's wage in excess of one year, even if the work continues at a startup. Additionally it may provide tens of thousands of euros per company in direct support and loan guarantees. It may donate or sell patents and other forms of intellectual property to startups with plans to exploit them. MEE and other public organisations also have measures that are directly targeted at former Nokia employees. In the end of 2012, they had established some three hundred new businesses.

2013 includes two tax incentives aimed at growth seeking businesses (see Section 2) and the government agreement on scaling up venture capital funding provide relevant instruments for developing growth entrepreneurship.

Assessment of the policy mix

According to the State and Quality of Science in 2012, for many years there has been a rather consistent policy to increase both the quality of research as well as its application. There has been a gradual shift from funding for applied research (for instance from Tekes) towards more funding for academic research (funding for universities and the Academy of Finland).

Internationalisation is among the greatest challenges in Finnish research policy. As mentioned before, Finland is rather internationalised in terms of publications but less so in researcher mobility and the share of foreign researchers as a proportion of the workforce. New developments have taken place especially in the strategies and development plans but in terms of actual measures the development has been slow. Increased independence of universities has allowed increasing possibilities for attracting foreign researchers.

Finnish research and innovation policies have been quite dominated by supply side instruments. The introduction of new demand measures discussed in earlier in this report has been slow and at the moment these elements still play a rather small role in the policy framework as a whole. No national evaluation has been carried out yet since these policies are relatively new.

Furthermore, the policy mix has been criticised for already being too complicated. Not much has been done to decrease the complexity of the national research and innovation system, but it has

been stated on the Government programme in 2011 that the division of labour between public sector actors contributing to growth and R&D funding needs to be clarified calling for improved co-ordination between various instruments that promote business R&D investments.

It can also be concluded that the lack of (growth) entrepreneurship has been taken seriously and has resulted in various actions, which are beginning to create positive outcomes. It is too early to assess if the actions have been sufficient or not. The direction, however, seems to be right. Other polices affecting R&D investments have not changed much recently and the administrative and legal frameworks have been relatively stable. The business environment is also quite open and competitive and public procurement has increased during recent years.

Table 2: Assessment of policy mix

Challenges	**Policy measures/actions addressing the challenge[1]**	**Assessment in terms of appropriateness, efficiency and effectiveness**
Weak internationalisation of the research and innovation system	Strategy for the internationalisation of Universities Internationalisation of science on key objective in the RIC Research and Innovation Policy Guidelines for 2011–2015 FiDiPro-programme Plans to renew the education legislation to better support both export of education and to attract international students to Finland.	Finland is rather internationalised in terms of co-publications but less so in researcher mobility and the share of foreign researcher workforce. The implementation has been rather slow, although developments have taken place in many areas. Increased independence of universities has allowed increasing possibilities for attracting foreign researchers. New funding models also support international publishing. FiDiPro –programme has worked well in attracting foreign top researchers. However the volume is rather small when looking at the broad picture.
The quality of scientific research and its better application	Increased funding to the Academy of Finland to support research excellence; New funding model of the universities has a performance-based component in it. Increase in Tekes funding and the creation of the Strategic Centres of Science, Technology and Innovation Specific funding for research infrastructures (FIRI)	There has been a gradual shift from funding for applied research (for example, from Tekes) towards more funding for academic research. Together with new funding models for the universities this seems to indicate that there is a real commitment to invest in better research performance. The increased emphasis on the quality of science is also visible in the new funding for research infrastructures; besides working actively within the ESFRI framework national specific funding for infrastructures has finally been introduced.

1 Changes in the legislation and other initiatives not necessarily related with funding are also included.

Challenges	Policy measures/actions addressing the challenge[1]	Assessment in terms of appropriateness, efficiency and effectiveness
The fragmentation of the higher education and the public research sector	The implementation of the university reform continues (e.g. new proposed funding model) The decision to carry out reform in the polytechnics in 2012 (new legislation planned)	University reform has given universities more possibilities to organise their activities; most universities have used this opportunity to renew their organisation as well as strategies, which may decrease fragmentation. A reform similar to universities is on-going for polytechnics by the MEC. This may have positive effect but it is yet too early to make judgements on the issue. The reform in PROs still underway and the general fragmentation of research between 3 different kinds of institutions exists.
Strong emphasis on supply side measures	A specific policy programme promoting demand side innovation has been established	The approach is very appropriate since Finland has very few demand side instruments and at the same time established instruments focus more on existing strong sectors. The initiatives are still in their very early stages so the effectiveness cannot be determined yet.
Concentration of private R&D to few sectors and businesses	Establishment of the VIGO accelerator programme Tekes Young Innovative Enterprises funding (YIE)	The VIGO programme targets start-up businesses in the very vulnerable phase. The 2012 review of growth enterprises notes that the 43 businesses in the Vigo -programme had collected about €70m growth funding by the end of 2012, of which 57% was private funding. Foreign investments counted for 32%. These positive results could give reason for scaling up of this instrument. The scaling up of venture capital funding was agreed by the government in March 2013. YIE has brought a specific funding for specific set of key businesses. The instrument is not yet evaluated.

5 NATIONAL POLICY AND THE EUROPEAN PERSPECTIVE

Finland has generally taken an active role in participating in the ERA. The European dimension is seen as a natural extension of the national policy for a small country with limited resources. In the report setting the research and innovation policy guidelines for 2011-2015, the Research and Innovation Council stated that "Finland is a proactive and influential partner in the EU and in the initiatives of the European research and innovation policy, such as in deepening cooperation within national R&D programmes and promoting top-level European research".

Based on analysis of the strengths and weakness of Europe's research systems and the overall objective of inducing lasting step-changes in Europe's research performance and effectiveness by 2014, the European Commission has defined the following ERA priorities (2012):

- More effective national research systems
- Optimal transnational co-operation and competition
- An open labour market for researchers
- Gender equality and gender mainstreaming in research
- Optimal circulation, access to and transfer of scientific knowledge.

While the Finnish R&I system has a long track-record in addressing these priorities strongly related with the challenges discussed earlier in this report, there also is an urgent need to upgrade the system to develop these areas further.

1. *More effective national research systems*

With regard effective research systems Finland has long experience in developing national, Nordic and European research programs encouraging healthy competition. Apart from universities and other higher education institutions (HEIs), facilitation of knowledge demand takes place through interactive joint preparation of various R&D programmes and other measures. The most important of these have been the research calls in the Strategic Centres of Science, Technology and Innovation (SHOKs), which have been jointly prepared by the stakeholders from the private sector, public sector and the higher education sector.

On the other hand Finland has a tradition of utilising the infrastructures and experimental arrangements of other countries. The work (discussed in Section 2) towards new national research infrastructures is a step into the right direction, but it is still too early to judge the success of the actions. The national regional policy liaises with the European Union (EU) cohesion policy. For the next period of the EU Structural Funds 2014-2020, research and innovation are among the priorities. In Finland, the focus is expected to be on enhancing infrastructure and capacities, promoting business R&I investment and a range of innovative actions through smart specialisation as well as supporting technological and applied research, pilot lines and early product validation.

2. *Optimal transnational co-operation and competition*

Finland is well represented in the European research landscape, being a member of all major European research organisations (European Organisation for Nuclear Research, European Molecular Biology Laboratory, European Space Agency, European Organisation for Astronomical Research in the Southern Hemisphere, European Synchrotron Radiation Facility).

Additionally Finland is active in both participating and coordinating European ERA-Net projects. The level of activity has also been good in Joint Programming Initiatives (JPIs), Joint Technology Platforms (JTPs) and Joint Technology Initiatives (JTIs).

The 2012 government action plan for research and innovation policy recognises that Finland has not utilised the opportunities offered by European and other international research funding to a sufficient degree: "Finnish researchers' knowledge of the application process, their objectives and activity with reference to the research programmes of the European Union are not at a sufficient level. Increasingly systematic utilisation of international research funding strengthens the preconditions for research and innovation activities and helps Finland develop its scientific expertise. A national programme to ensure the best possible utilisation of EU's research and innovation activities, such as the Horizon 2020 programme, is created as part of the efforts to promote the internationalisation of the research and innovation system. The national support and advisory service for the applicants of EU funding is renewed accordingly."

The other important funding agency in Finland, Tekes has collaborative partnerships with several countries, such as the USA, Japan, China and European countries. The FinNode Centres (global network of Finnish innovation organisations operating via nodes in global innovation activity) in China, India, Japan, Russian and the USA are also valuable instruments for international cooperation.

3. *An open labour market for researchers*

There is a need to attract more qualified researchers and other labour in order to support and sustain the relatively high level of Finnish research and innovation system. The amount of researchers has risen during the past few years due to an efficient graduate school system. This has not, however, been reflected in the share of foreign researchers or in the mobility of either students or staff at Finnish HEIs. Persistent weaknesses in the Finnish research system for attracting researchers from abroad include limited career opportunities for researchers with few permanent positions and therefore a dependence on short term funding, the remuneration level has been lower than in many other European countries, families and especially spouses have had difficulties in getting a job, and the administration issues, for instance in universities, have also been seen as a challenge. There are rules and practices to help foreign researchers to work in Finland. Information is fragmented however and there has not been a dedicated programme to facilitate the immigration of foreign experts. Another issue has been the insufficient willingness of the private sector to recruit foreign researchers except for the few international businesses.

The FiDiPro –programme is one of the tools established in Finland to tackle the issue of attracting talent from abroad alongside the rather new four-tier career model. Additionally Joint Degree Programmes have been initiated in Finnish universities to target foreign students aiming at Master's Degree level. So far the actions taken have not improved the situation and therefore other policies or measures should be considered.

Enhancing international cooperation is considered important in Finland because it is closely linked to the degree of internationalisation of science and the mobility of researchers. The Academy of Finland has a commitment to promoting the internationalisation of Finnish science and research by establishing bilateral agreements with countries and regions. The Academy of Finland provides funding for the Finnish Centres for Excellences (CoE) in order to support international cooperation in research. More could still be done, however, as Finland is not considered a hotbed of scientific research and fails to attract foreign researchers on a larger scale.

4. *Gender equality and gender mainstreaming in research*

According to a study in 2009 the Government programmes and the Government Action Plans for Gender Equality have incorporated ambitious objectives for the promotion of gender equality in higher education and in the field of science. The objectives during the period of review have included dismantling segregation, reinforcing gender sensitivity in teacher education, promoting women's research careers, and establishing the status of women's studies. Based on the results of the study, university and science policy had included relatively few concrete measures that enable the integration of gender equality into all actions regarding higher education and science. The long-standing gender equality work of the Academy of Finland has served as an example of how gender equality issues can be successfully integrated into activities. In 2011, more than 50% of the public sector research and development personnel were women (Academy of Finland, 2012).

5. *Optimal circulation, access to and transfer of scientific knowledge*

The 2012 government action plan for research and innovation policy identifies the following action points in view of research and innovation information management.

- The public data resources may function as a raw material for research and innovation much more effectively than has been the case so far.
- The Ministry of Finance is about to launch an Open Data programme by which the public sector will expedite the opening and availability of data as concerns its own data resources.
- The action plan further notice that effective utilisation of public sector data in innovation activities requires the expedition of application and service development projects implemented by businesses, the strengthening of research, education and training and advisory services concerning the opening and utilisation of the data as well as new support services that can be used, among other things, to strengthen the innovation activities of communities utilising the open data and the development of data resources to be implemented in cooperation between public authorities and users.

The public-private partnerships are mainly facilitated through the Tekes R&D programmes as well as the SHOKs. Instead of being only a shareholder the private sector is also involved in planning the strategic research agenda for the research programmes coordinated by the SHOKs. As discussed in Section 2, despite major advances SHOKs require further adjustments in the Finnish research and innovation policy.

REFERENCES

Council of the European Union (201): Council recommendation on the national reform program me 2012 of Finland and delivering a Council opinion on the Stability Programme of Finland, 2012-2015. http://register.consilium.europa.eu/pdf/en/12/st11/st11252.en12.pdf, accessed 2013/03/30.

Finnish Government (2011): Programme of Prime Minister Jyrki Katainen's Government, 2011:6, http://valtioneuvosto.fi/hallitus/hallitusohjelma/pdf/fi.pdf, accessed 3013/03/30.

Finnish Science and Technology Information Service (2010): http://www.research.fi, accessed 3013/03/30.

Global Entrepreneurship Monitor, (2011): Global Report 2010, 2011:8, http://www.gemconsortium.org/, accessed 3013/03/30.

European Commission (2012): Innovation Union Scoreboard 2011, http://ec.europa.eu/enterprise/policies/innovation/files/ius-2011_en.pdf, accessed 2013/03/30.

European Commission (2011): Innovation Union Scoreboard 2010. 2011:2, http://www.proinno-europe.eu/sites/default/files/docs_EIS2010/IUS_2010_final.pdf, accessed 3013/03/30.

European Commission (2011): Innovation Union Competitiveness Report, Directorate-General for Research and Innovation. http://ec.europa.eu/research/innovation-union/pdf/competitiveness-report/2011/iuc2011-full-report.pdf#view=fit&pagemode=none , accessed 3013/03/30.

Eurostat (2013): Basic figures on the EU. Spring 2013 edition. http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-GL-13-001, accessed 2013/03/30.

Ministry of Education and Culture (2009): The strategy for internationalisation of the higher education sector 2009–2015. Publication of the Ministry of Education and Culture, 2009:21

Ministry of Education and Culture (2009): National-level Research Infrastructures. Present state and roadmap. Publication of the Ministry of Education, 2009:4

Ministry of Education and Culture (2011): The Second Report of the Citation Index Working Group, Publication of the Ministry of Education and Culture, Finland 2011:34

Ministry of Education and Culture (2011): KOTA database. 2011:8, https://kotaplus.csc.fi/online/Etusivu.do, accessed 3013/03/30.

Ministry of Employment and the Economy (2011): Growth Company Review, 2011:4, http://www.tem.fi/files/29659/TEM_Kasvuyrityskatsaus_2011.pdf, accessed 3013/03/30.

Ministry of Employment and the Economy & the Ministry of Education and Culture (2009): Evaluation of the Finnish National Innovation System. Full Report. 2009:10.

http://www.tem.fi/files/24928/InnoEvalFi_POLICY_Report_28_Oct_2009.pdf, accessed 3013/03/30.

OECD (2010): OECD Science, Technology and Industry Outlook 2010. Paris.

OECD (2011): OECD Science, Technology and Industry Scoreboard 2011. Innovation and Growth in Knowledge Economies. Paris.

OECD (2012): OECD Science, Technology and Industry Outlook 2012. Paris.

Research and Innovation Council of Finland. (2010): Research and Innovation Policy Guidelines for 2011 -2015, http://www.minedu.fi/export/sites/default/OPM/Tiede/tutkimus-_ja_innovaationeuvosto/julkaisut/Review2011-2015.pdf, accessed 3013/03/30.

Statistics Finland (2013): Government to fund R&D activity with EUR 2 billion in 2013. Press release, 2013/02/27, http://www.stat.fi/til/tkker/2013/tkker_2013_2013-02-27_tie_001_en.html, accessed 2013/03/30.

Statistics Finland (2012): Finland in Figures. http://www.stat.fi/tup/suoluk/index_en.html, last updated 13.6.2012, accessed 2013/03/30.

Statistics Finland (2012): Research and development 2011. Tutkimus- ja kehittämistoiminta. ISSN=1798-6206. 2011. Helsinki. http://www.stat.fi/til/tkke/2011/tkke_2011_2012-10-31_tie_001_fi.html, accessed 2013/03/30.

Stenholm, P. et al. (2011): Global Entrepreneurship Monitor. Finnish 2010 Report. University of Turku. 2011:1,

Tekes (2011): Growth and Wellbeing from Renewal. 2011:3, http://www.tekes.fi/en/community/Strategy/343/Strategy/1280, accessed 3013/03/30.

Viljamaa, K.,et al., (2010): Tutkimuspolitiikan käytännöt ja välineet – viiden maan vertailu" (Research Policy: Tools and Practices: A Five-Country Comparison), Suomen Akatemian julkaisuja 2010:2

Viljamaa, K & Lahtinen, H. (2011): ERAWATCH Analytical country report 2011: Finland, http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/reports/countries/fi/report_0005, accessed 2013/03/30.

LIST OF ABBREVIATIONS

BERD	Business Expenditures for Research and Development
CERN	European Organisation for Nuclear Research
CoE	Centres of Excellence
COST	European Cooperation in Science and Technology
EMBL	European Molecular Biology Laboratory
EPO	European Patent Office
ERA	European Research Area
ERA-NET	European Research Area Network
ERDF	European Regional Development Fund
ERP Fund	European Recovery Programme Fund
ESA	European Space Agency
ESFRI	European Strategy Forum on Research Infrastructures
ESO	European Organisation for Astronomical Research in the Southern Hemisphere
ESRF	European Synchrotron Radiation Facility
ETP	European Technology Platform
EU	European Union
FP	European Framework Programme for Research and Technology Development
EU-27	European Union including 27 Member States
FDI	Foreign Direct Investments
FiDiPro	Finland Distinguished Professor Programme
FINHEEC	Finnish Higher Education Evaluation Council
FIRI	Funding Instruments for Research Infrastructure
FP	Framework Programme
FP7	7th Framework Programme
FTE	Full-time equivalent
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
GUF	General University Funds
HEI	Higher education institutions
HERD	Higher Education Expenditure on R&D
HES	Higher education sector
KOKO	Regional Cohesion and Competitiveness Prrgoramme
INKA	Innovative Cities Programme
ICT	Information and Communication Technology
IP	Intellectual Property
JPI	Joint Programming Initiative
JTI	Joint Technology Initiative

JTP	Joint Technology Platform
MEE	Ministry of Employment and the Economy
MEC	Ministry of Education and Culture
MoF	Ministry of Finance
NCoEs	Nordic Centres of Excellence
NRP	National Reform Programme
OSKE	Centre of Expertise Programme
OECD	Organisation for Economic Co-operation and Development
PCT	Patent Cooperation Treaty
PISA	Programme for International Student Assessment
PPS	Purchasing Power Standard
PRO	Public Research Organisations
RELEX	Retail Logistics Excellence
R&D	Research and development
R&I	Research and Innovation
RI	Research Infrastructures
RIC	Research and Innovation Council
RIS3	Research and Innovation Strategies on Smart Specialisation
RTDI	Research Technological Development and Innovation
SF	Structural Funds
SHOK	Strategic Centre for Science, Technology and Innovation
Sitra	Finnish Innovation Fund
SME	Small and Medium Sized Enterprise
S&T	Science and technology
Tekes	Finnish Funding Agency for Technology and Innovation
TTO	Technology Transfer Offices
VC	Venture Capital
VTT	Technical Research Centre of Finland
YIE	Young, Innovative Enterprises –programme

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Abstract
This analytical country report is one of a series of annual ERAWATCH reports produced for EU Member States and Countries Associated to the Seventh Framework Programme for Research of the European Union (FP7). The main objective of the ERAWATCH Annual Country Reports is to characterise and assess the performance of national research systems and related policies in a structured manner that is comparable across countries.
The Country Report 2012 builds on and updates the 2011 edition. The report identifies the structural challenges of the national research and innovation system and assesses the match between the national priorities and the structural challenges, highlighting the latest developments, their dynamics and impact in the overall national context. They further analyse and assess the ability of the policy mix in place to consistently and efficiently tackle these challenges. These reports were originally produced in December 2012, focusing on policy developments over the previous twelve months.
The reports were produced by independent experts under direct contract with IPTS. The analytical framework and the structure of the reports have been developed by the Institute for Prospective Technological Studies of the Joint Research Centre (JRC-IPTS) and Directorate General for Research and Innovation with contributions from external experts.

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As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.

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